APPENDIX C

RIVER HYDRAULICS AND FLOODPLAIN ISSUES OPPORTUNITIES AND CONSTRAINTS REPORT

SAN LUIS REY RIVER PARK MASTER PLAN

SAN DIEGO COUNTY, CALIFORNIA

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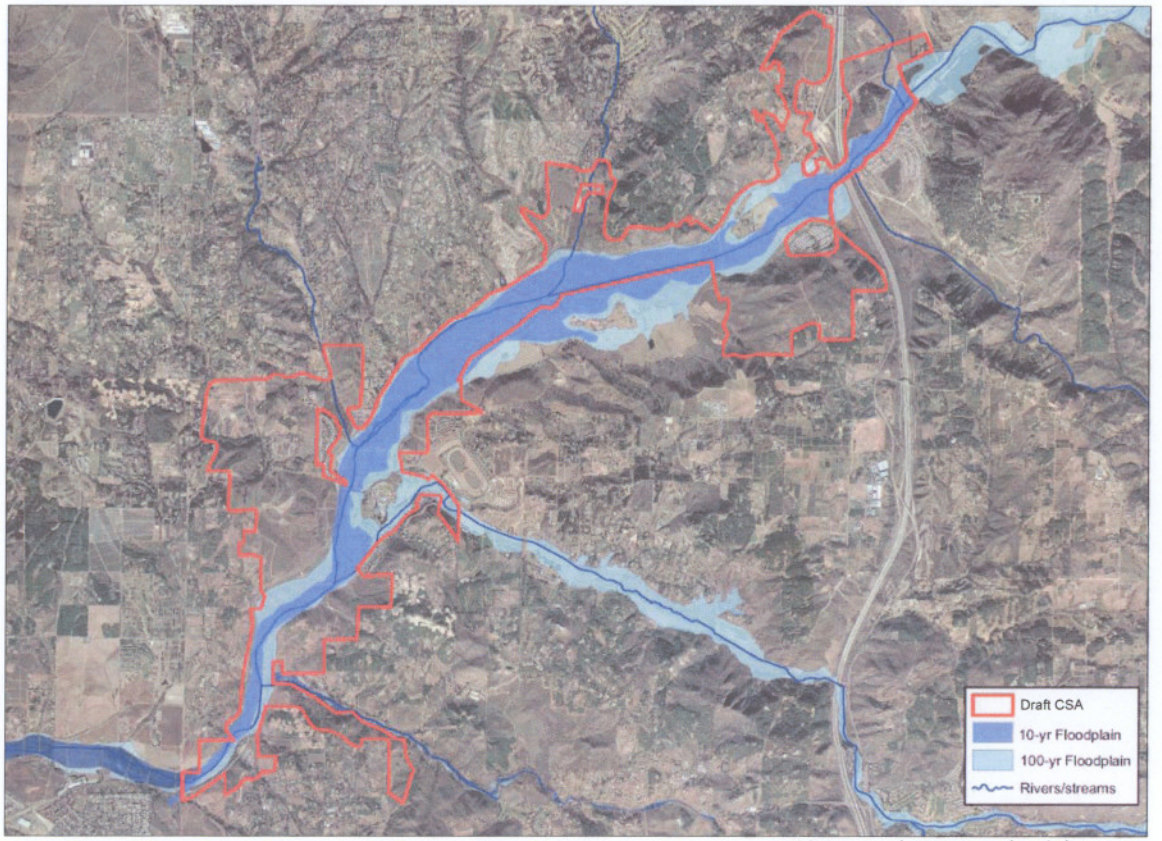
PURPOSE

The San Luis Rey River Floodplain runs the length of the Core Study Area. The core study area also includes a portion of Moosa Canyon Creek, a tributary that joins the San Luis Rey River near Bonsall. At Bonsall, the San Luis Rey River watershed is approximately 513 square miles in size. The purpose of this study is to determine the regulatory and physical constraints resulting from potential floodwaters, and to identify resulting opportunities and constraints relating to the proposed development of the San Luis Rey River Park.

METHODOLOGY

The County of San Diego furnished Nasland Engineering with copies of various hydrology studies, digital and paper copies of hydraulic modeling and floodplain mapping information. In addition, we have made use of Flood Insurance Rate Maps (FIRMs) published by the Federal Emergency Management Agency pursuant to the National Flood Insurance Program, a visual reconnaissance of the river and topographic information from available aerial surveys. We have researched applicable County ordinances and the Code of Federal Regulations regarding development in and around floodplains.

This study has resulted in a delineation of the 10-year and 100-year floodplains within the Core Study Area. A 100-year flood is one that is predicted to be exceeded in magnitude once in every 100 years on average. Stated another way, a 100-year flood has a 1% probability of occurring in any particular year. The hydrology and the hydraulic model utilized in this study were provided by the County of San Diego. Using that information, Nasland Engineering has evaluated the area inundated by the 100-year and 10-year flood events and compared the limits of inundation by the 100-year flood to current flood plain mapping.



10-Year and 100-Year Floodplain Map

EXISTING AND FUTURE CONDITIONS WITHIN CORE STUDY AREA

The Core Study Area has been the subject of a number of storm water hydrology and hydraulic analyses. A hydrology study for all major County streams including the San Luis Rey River was undertaken by the California Department of Water Resources in 1964 (Bulletin 112). This study utilized stream flow records from County streams under a wide variety of hydrologic characteristics, and resulted in flood lines being drawn for the predicted 50-year and 100-year floods.

In 1968, the Corps of Engineers published a Review Report for Flood Control in the San Luis Rey River, including definitions of the standard project and other floods for the lower 7 miles.

In 1974, the County of San Diego Department of Sanitation and Flood Control published a report that summarized the results of a detailed hydrology study undertaken by the County for the San Luis Rey River utilizing data from stream flow and rainfall gages within the watershed. The studies were conducted for the purpose of facilitating floodplain mapping as required by the Federal Flood Insurance Program. The study produced predictions for the 10-year and 100-year peak storm flow at points along the river using various assumptions regarding the outflow from Lake Henshaw. The resulting flood flows were generally consistent with those in Bulletin 112.

Below is a summary of the peak flows for the 10-year and 100-year storms based on the County's 1974 hydrology study.

PEAK FLOWS (CUBIC FEET PER SECOND)		
	10-year	100-Year
SLR River Below Confluence	6,200	48,000
SLR River Above Confluence	5,000	41,000
Moosa Canyon Creek	-	13,500

The County completed floodplain mapping in December, 1975 using the HEC-2 computer program. Input into this program included a model of the physical aspects of the river together with the peak flood flows predicted in the hydrology study.

In October, 1988 the County of San Diego released a report entitled "A Floodplain Management Study for Moosa Canyon Creek." The study, conducted by Cooper Engineering Associates under contract with the County focused on the reach of Moosa Canyon Creek within a mile upstream of the confluence with the San Luis Rey River. The report included a comparison of topographic data of the river channel from 1960, 1973, 1980 and 1983. Over that time, major changes had occurred in the shape of the river cross sections including the relocation of the low flow into several incised channels and significant aggradation of the river bed near the confluence.

The limits of the 100-year floodplain are depicted on FIRM panels 06073C0479, 0483, 0486 0487, 0488, 0491. These maps were most recently updated in June of 1997; apparently relying on the County supplied hydraulic modeling from 1975. The majority of the floodplain is designated as "Zone A" (Special flood hazard areas inundated by 100-year flood – no base flood elevations determined)) with a note that the area is "subject to possible erosion / sedimentation hazards." Outside of "Zone A", some portions of the floodplain are designated as shaded "Zone X" (Areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile).

CONSTRAINTS WITHIN CORE STUDY AREA

Regulatory Constraints

Federal Floodplain Regulations

Title 44, Part 60 of the Code of Federal Regulations (44CFR) contains a number of floodplain development standards and provides that flood insurance shall not be sold or renewed within any community unless the community has adopted adequate flood plain management regulations consistent with the federal criteria. The regulations "must be legally-enforceable, applied uniformly throughout the community to all privately and publicly owned land within the flood-prone...areas, and the community must provide that the regulations take precedence over any less restrictive confliction local laws, ordinances or codes." Thus, the federal law establishes minimum criteria that must be followed by any community eligible for flood insurance. The County of San Diego is a participating community in this program, and has adopted a regulatory floodway that is identical to "Zone A" on the FIRM.

Minimum standards in 44CFR for Flood Hazard "Zone A" include the following:

> The community must require permits for all proposed construction and review all permit applications to ensure that all governmental approvals such as 404 permits are obtained, and to ensure buildings are reasonably safe from flooding.
>
> The community must require that all proposed developments more than 5 acres in size include base flood elevation data. For the San Luis Rey River, the County has such data, but it is not currently reflected on the FIRM.
>
> The community must obtain the elevation of the lowest floor (including basement) of all new or substantially improved structures.
>
> Once a base flood elevation is established, all new and substantially improved residential structures must have the lowest floor elevated above the base flood level unless the community is granted an exemption. Non-residential new or substantially improved structures must have the lowest floor elevated to above the base flood level or be flood-proofed and capable of resisting hydrostatic and hydrodynamic loads as well as the effects of buoyancy. Although not specifically called for in the regulations, it is the practice of FEMA to require the ground surrounding residential structures in a flood prone area to be one foot above the base flood elevation. A "structure" is defined in 44CFR as a building with two or more outside rigid walls and a fully secured roof, that is affixed to a permanent site, a manufactured home built on a permanent chassis or a travel trailer without wheels, built on a chassis and affixed to a permanent foundation." The term "residential structure" is not specifically defined in 44CFR.
>
> The community must assure that the flood carrying capacity within any altered or relocated watercourse is maintained.

There are no federally mandated restrictions relating to hydraulic issues outside of "Zone A" on the FIRM. However, those areas in shaded "Zone X" may be subject to inundation unless they are filled to an elevation above the level of the 100-year flood.

County Floodplain Regulations

County regulations regarding development in floodplains are contained in Section 87.601 et seq of the County Code of Regulatory Ordinances (Chapter 6, Watercourses), Section 5307 (b) of the Zoning Ordinance (Floodways) and Section 5450 of the Zoning Ordinance (Flood Channel Regulations).

Chapter 6 generally mirrors 44 CFR. The Ordinance prohibits the construction or substantial improvement of structures within a designated floodplain "unless the lowest floor (including basement) is elevated to or above the level of the 100-year flood or the structure including attendant utility and sanitary facilities, is

flood-proofed up to the level of the 100-year flood." A grading permit is required for any acts that might impair or accelerate the flow of water in a watercourse, reduce the capacity of a watercourse, construct, alter or remove any flood control structures, place any structure in upon or across a watercourse or create any encroachment that would increase the flood level or impair the ability of a floodway to carry and discharge the waters resulting from a 100-year flood. Exceptions are allowed for emergencies, some agricultural activities, certain utilities construction, specified surface mining operations, maintenance and repair of structures that does not represent a substantial improvement, and parking facilities that will not impede the flow of floodwaters or which serve a non-residential building.

Section 5307(b) of the County Zoning Ordinance specifically prohibits the development of permanent structures for human habitation within a designated floodway. Permitted uses are limited to "agricultural, recreational and other such low intensity uses" that will not harm the environmental values of the floodway and to mineral extraction subject to an approved Major Use Permit with specified mitigation measures.

Section 5450 et seq of the County Zoning Ordinance regulates development within floodplains for the purpose of protecting persons and property. Section 5468 states as follows:

> "Except as provided in Section 5464, no building or structure may be placed, erected, constructed or expanded in a floodway unless the facility is not designed or used for human habitation or as a place of work or by the public and unless the Director of the Department of Sanitation and Flood Control determines such building or structure will not adversely affect or unduly hinder, restrict or alter the water-carrying capacity of the floodway and will not result in any increase in flood levels during the occurrence of a 100-year flood."

Summary of Regulatory Constraints

Federal and County regulations regarding development in flood prone areas are intended to promote public safety and to limit property damage. Some types of activities such as residential structures and structures used as workplaces are clearly prohibited within designated flood hazard zones. Other activities such as agriculture, recreational uses and parking are allowed under certain circumstances. There is room for interpretation and judgment regarding certain non-residential structures.

Any permanent structure constructed within a floodplain must be capable of withstanding flood flows. Also, grading or anything constructed or planted within a floodplain must not impede flood flows. For example, a light pole would likely be acceptable, whereas a baseball backstop might not. Tree planting within a floodplain is normally acceptable but must be carefully planned. All proposed work within the 100-year floodplain must be analyzed to determine the resultant effect during flood flows. Any action that might endanger public safety or cause property damage is prohibited. Also, approval must be obtained from FEMA before any significant alteration of the floodplain.

44CFR contains provisions for the alteration of floodplains, and the consequent revision of Flood Hazard Zones. Assuming a proposed physical alteration is acceptable from an environmental standpoint, a Conditional Letter of Map Revision (CLOMR) must first be processed with FEMA. The alteration may be made only if and after the CLOMR is approved. Once the alteration is completed, a Letter of Map Revision (LOMR) must be processed. The FIRM is then changed to reflect the altered floodplain.

Practical Constraints

Floodplains are better suited to some uses than to others. Even where there is little or no danger to life or property, frequent flooding can present a maintenance problem for highly landscaped areas and certain types of facilities. Some judgment is necessary when planning recreational uses in floodplains. For example, a playing field intended for winter sports should not become inundated with minor rainfall. Similarly, a trail that is frequently under water may be costly to maintain and repair and may become unusable too often. Electrical systems that are subject to inundation need to be waterproofed and require a much higher degree of maintenance than similar systems that remain dry. Where possible, it is best to place such facilities outside the path of frequently occurring storm water flows. For the purpose of this study, the 10-year storm floodplain has been selected as a reasonable break point for the siting of Tier A facilities that may be sensitive to frequent inundation. Low impact recreational facilities (Tiers B & C) are suitable for placement within the 10-year floodplain if they are designed to withstand flooding.

Limits of 100-year and 10-year floods

Nasland Engineering has utilized the HEC-2 models that were previously used for floodplain mapping by the County. The program has been run using the 100-year peak flows for both the San Luis Rey River and Moosa Canyon Creek. From the HEC-2 output, the limits of inundation have been plotted. The results are generally consistent with, although not identical to existing floodplain mapping. For a planning level study, the differences are not significant. However, prior to final design of any facilities, the model should be updated based on current and accurate topography. For San Luis Rey River the program also has been run using the 10-year peak flow. The limits of the 10-year flood are much more sensitive to minor physical changes in the river bed and banks than are those for the 100-year flood. The October, 1998 study indicated profound changes occurring over time in the Moosa Canyon Creek, enough to make any analysis of the 10-year floodplain meaningless.

Planned improvements of State Route 76

The State Department of Transportation (Caltrans) is currently studying various alternatives for improving SR-76 through the study area. Alternatives under evaluation include widening the road in its current location as well as the construction of a relocated, wider road along several possible alignments. All of the alternatives will have some effect on the San Luis Rey River floodplain, and thus will require revision to the FIRM and the designated floodway.

OPPORTUNITIES WITHIN CORE STUDY AREA

Areas outside of the designated 100-year floodway

It is anticipated that most structures will be placed outside of the designated floodway. Property outside of the designated floodway is not subject to regulation by FEMA or to the County regulations relating to flood prone areas, although the land may be classified as wetlands. Any structure constructed in shaded "Zone X" as shown on the FIRM will require fill to bring the lowest floor above the level of the 100-year flood. Neither 44CFR nor County floodplain regulations prohibit the placement of fill in shaded "Zone X".

Areas within the 100-year floodway but outside the limits of the 10-year flood

It may be desirable to place some structures within the designated 100-year floodway. Is so, such structures must be consistent with federal and county regulations. It may be appropriate and legally permissible to construct certain structures such as observation decks out over the floodway, using either cantilever or pier foundations. Any structure placed below the level of the 100-year flood must be flood-proofed, designed to withstand the forces associated with floodwaters and must not impede the flood flow.

The zone between the 10-year and 100-year floodplain limits is an appropriate location for recreational uses including athletic fields, trails ans passive activities. Such uses are permitted provided they do not impede the flood flow. It is likely that tree planting and grading will be necessary for facilities planned within the designated 100-year floodplain. The potential effect of any such activities will need to be studied. There must be no threat to property or public safety and no resulting property damage. If the limits of the floodway will be changed, or if there will be significant change to the elevation or velocity of floodwaters it will be necessary to obtain a CLOMR from FEMA before the work is accomplished, and then to modify the flood plain maps and process a LOMR after construction is completed.

Areas within the limits of the 10-year flood
Land within the 10-year floodplain is suitable only for recreational uses such as sports fields and trails that will not suffer significant damage as a result of frequent flooding. Trail bridges across the floodway and permanent architectural structures should be built above the 100-year floodplain levels. Any significant alteration of the flood water surface elevation will require processing with FEMA.

Utilities and park amenities that would b e damaged by flooding should be kept out of the 10-year floodplain.

Improvements to State Route 76
The widening and/or relocation of SR-76 will almost certainly result in the alteration of the 100-year floodplain. There should be an opportunity to integrate some river park elements into the proposed construction. At the least, design for the road improvements will include updating of the floodplain studies, and allow for more precise park planning.

The opportunities and constraints described above should be considered in the development of the plan for the San Luis Rey River Park. The most intense development should be outside the limits of the 10-year floodplain. Within the designated 100-year floodway, grading activities should be carefully designed so as not to impede the flow of floodwaters. Prior to any detailed planning in or near the floodplain, it is strongly recommended that the hydraulic modeling be updated and revised as necessary to reflect the current topography and other physical features of the land. Continued coordination of park planning with the proposed widening and realignment of SR76 is strongly recommended. Opportunities for integrating some park elements into the SR-76 project should be pursued.

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